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Managing Water in the West

Avian Post Development Monitoring At Pratt Restoration Site Breeding Season 2005

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Bureau of Reclamation Lower Colorado Region
Multi-Species Conservation Program

U.S. Department of the Interior
Bureau of Reclamation
Lower Colorado Regional Office
Boulder City, NV 89006

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Table of Contents

Abstract 3
Introduction 4
Study Area 5
Methods 5
Results 7
  Area searches 7
  Tape playback surveys for the southwestern willow flycatcher 7
Discussion 8
Literature Cited 10

List of Tables and Figures

Table 1. Mean relative abundance of resident birds detected during area searches, per species at the Pratt Restoration Sitebreeding Season 2005……9
Table 2. Mean relative abundance of migrant birds detected during area searches, per species at the Pratt Restoration Site breeding Season 2005……9
Table 3. Species richness, ecological species diversity and evenness at the Pratt Restoration Site for resident species breeding Season 2005……10
Table 4. Behavioral observations at Pratt Restoration Site, breeding season 2005……..10

Figure 1. Mean relative abundance of resident species at the Pratt Restoration Site, breeding season 2005……..11
Figure 2. Comparison of mean relative abundance for the most abundant resident species and standard error bars at the Pratt Restoration Site, breeding season 2002-2005……..12

List of Appendices

Appendix 1. Aerial view of the Pratt Restoration Site, number of trees planted in each area and area search sections……13-14
Appendix 2. Data form used for area searches……..15
Appendix 3. Standard AOU (American Ornithological Union) Codes used for North American Bird Species.....16

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Abstract

Reclamation has established small demonstration restoration projects along the lower Colorado River beginning in 1997 for studying ecological restoration techniques. The Pratt Restoration Site is a 4.9 hectare cottonwood-willow restoration project located in Yuma County, south of Mittry Lake. Avian post development monitoring of this site is vital to the adaptive management process of the Lower Colorado River Multi-Species Conservation Plan (LCR MSCP). Southwestern willow flycatcher surveys and avian area searches were conducted during the breeding seasons of 2002-2005. A mean of 75.2 birds, comprising 38 species, were detected at the Pratt Restoration Site during the breeding season of 2005. Seven migrant willow flycatchers were detected at the Pratt restoration sites in 2005. Five species comprised 60% of the population at the Pratt Restoration Site: mourning dove (*Zenaida macroura*), brown-headed cowbird (*Molothrus ater*), Bullock's oriole (*Icterus bullockii*), western kingbird (*Tyrannus verticalis*), and the Abert's towhee (*Pipilo aberti*). The only species covered under the LCR MSCP detected at the site was the Sonoran yellow warbler (*Dendroica petechia sonorana*).

Introduction

The lower Colorado River (LCR) travels from Lees Ferry, south of Glen Canyon Dam to the Gulf of California in Mexico. Flowing through the Mohave and Sonoran deserts, the LCR provides a large expanse of riparian vegetation in an arid environment (American Bird Conservancy 2003). Over 90% of riparian habitat has been lost to river channelization, agricultural land conversion, habitat destruction, urban development, mining, overgrazing, and invasion of salt cedar (*Tamarix sp.*) (Rosenberg *et al.* 1991, Powell and Stiedl 2000).

The Pratt Restoration Site is a demonstration restoration project that was established in 1999 as a requirement of Reasonable and Prudent Alternative (RPA) 14 in the 1997 Biological and Conference Opinion on Routine Operations and Maintenance of the Lower Colorado River. RPA 14 required Reclamation to establish demonstration projects to study ecological restoration techniques along the LCR (USFWS 1997). The Pratt Restoration Site was established by Reclamation and the Bureau of Land Management (BLM) to create specific habitat for the southwestern willow flycatcher (*Empidonax traillii extimus*) (Raulston 2003). Post development monitoring of this site provides ecological data to be utilized in the adaptive management process of the LCR MSCP.

The LCR MSCP, signed on April 4, 2005, is a 50 year cooperative Federal-Lower Basin States-Tribal-Private effort to provide conservation measures for 26 covered species while providing regulatory relief for ongoing and future river management operations (LCR MSCP HCP 2004). Two conservation measures of the LCR MSCP are: 1) creation and maintenance of habitat and 2) adaptive management through monitoring and research. Both

conservation measures are expected to benefit LCR MSCP covered and non-covered species (LCR MSCP HCP 2004). One of the four components of the adaptive management process is post development monitoring (LCR MSCP HCP 2004). The purpose of avian post development monitoring is to collect avian abundance, diversity and richness data at each restoration project to analyze effectiveness of created habitats. Reclamation has conducted avian post development monitoring each breeding season since 2002 at the Pratt Restoration Site using two methods: avian area searches and tape playback surveys for the southwestern willow flycatcher (Sogge *et al.* 1997).

Study Area

The Pratt Restoration Site is located north of Interstate 8, near Yuma, AZ on land administered by the Bureau of Land Management. The site is north of Laguna dam, south of Mittry Lake, and is surrounded by farm fields and *Tamarix sp*. In the fall of 2003, *Tamarix* sp. was removed and will be restored with native vegetation. A leaseholder farmed the 4.9 ha site since 1949. In 1999, Reclamation established six planting regimes with Fremont cottonwoods (*Populus fremontii*), Goodding willows (*Salix gooddingii*), and coyote willows (*Salix exigua)* using potted plants, seeds and poles. Potted plants and poles were planted densely, from 1 to 3 m apart (Raulston 2003). Seeded areas were planted with cottonwood and willow seeds collected locally and broadcast by hand over wet soils (Raulston 2003). *Baccarus* sp. have been independently established in a potted cottonwood plot and *Tamarix* sp. have been established in the seeded areas. New individuals have been independently established in the potted coyote willow population (U. S. Bureau of Reclamation 2003). After four years of growth, the site has developed into a cottonwood-willow gallery forest with an understory of bermuda grass (*Cynodon dactylon)* and *baccarus* species (BLM 2004). Currently, the site is being jointly managed by Reclamation and the BLM to promote different size classes with an overstory, a sub canopy, and a dense shrub layer through harvesting poles and cuttings in certain areas (BLM 2004).

Area searches were conducted by dividing the site into 5 sections; ranging in size from 1 to 2 hectares. Appendix 1 gives an aerial view of the site, the number of trees planted in each area, and the area search sections.

Methods

Tape play back surveys for the southwestern willow flycatcher were conducted during the breeding season of 2005 (May 17th to July 26th) at the Pratt Restoration Site. The methodology for the southwestern willow flycatcher surveys can be found in the report; "*Tape playback surveys for the southwestern willow flycatcher breeding season 2005*" (USBR 2005). Data analysis was not conducted as no breeding southwestern willow flycatchers were present at the site.

Area searches were conducted 10 times during the breeding season of 2005 (May 17th to July 26th) at the Pratt Restoration Site. Area searches were conducted according to protocol defined in *"Handbook of Field Methods for Monitoring Landbirds"* (Ralph *et al* 1993). Each area search was conducted by one observer beginning at sunrise and ending no later than 9:00 AM. Temperature, cloud cover and wind speed were recorded before each area search. Start and ending times were also recorded. During the twenty minutes, observers attempted to survey all areas within each section equally (Ralph *et al* 1993). Each individual bird heard or seen was recorded on the data form along with the method of detection (visually or aurally) (Ralph *et al* 1993). If the bird was detected by more than one method, the method with the highest priority was recorded. Singing represented the highest priority, visually the second highest priority, and calling the lowest priority. Behavior information recorded for each bird included foraging, carrying food, displaying, copulating, flocking, mating, nesting, and fledging (Ralph *et al.* 1993). Bird species flying over the area but not utilizing it were recorded in a separate category as "flyovers". Refer to Appendix 2 for a copy of the data form.

For data analysis, species were separated into "resident" or "migrant" categories according to the Birds of the Lower Colorado River (Rosenberg *et al.* 1991*).* The total number of individual birds detected per area search period was calculated by totaling individuals detected in all five sections. Mean relative abundance was calculated for total individuals and individuals per species by dividing the total number of individuals detected by the number of surveys conducted. Migrant birds did not occur at the site through all 10 survey periods. The number of periods that they are present varies in species, sites and years. For consistency purposes, mean relative abundance of migrant species was determined by dividing individuals detected by the total number of surveys conducted (usually 10). Area searches are a breeding bird survey and are not designed to count migrants. We include migrants in our count because they are present during the breeding season, but the area search method will underestimate the number of migrants present. The standard error and standard deviation were calculated for mean relative abundance of each species. A single factor ANOVA test was used to determine significant difference of mean relative abundance of total individual birds and individual birds per species between years. If a there was a significant difference of mean relative abundance between years, a tukey multicomparison test was used to determine in which years the means differed. Ecological species diversity and evenness for the site and each individual section was calculated using a natural logarithm version (Nur *et al.* 1999) of the Shannon-Wiener Index (Krebs 1989).

The equation using natural logarithms is:

$$H' = \sum_{i=1}^{i=S} (p_i)(\mathrm{In}p), \quad i = 1, 2, \ldots S$$

where S = number of species in the sample, and p_i is the proportion of all individuals belonging to the *i*th species. The transformation of H′ is given by $e^{H'}$ that is labeled as N_1 (MacArthur 1965). N_1 is used because it expresses diversity in terms of species whereas H′ is expressed in bits. Species distribution is maximally even when $S = N_1$. Ecological species diversity index provides more information about community composition than species richness as it takes the relative abundance of different species into account. Evenness expressed as $H'/H_{max} = H'/\mathrm{In}\ S$ is a measurement of species similarity; it is the equitability with which individuals are distributed among the different species. Evenness measurements are on a scale of 0 to 1 with zero being. Evenness is equal to 1.0 when there are similar proportions of all species and approaches zero as proportions of species become more dissimilar. Species richness is calculated as the number of species present at the site.

Results

Area searches

A mean of 75.1 individual resident birds, comprising 32 species, and a mean of .8 individual migrant birds, comprising 6 species, were detected at the Pratt Restoration Site (Figure 1; Table 1 and 2). Refer to Appendix 3 for a list of common names, scientific names and American Ornithological Union (AOU) codes of species observed. The most abundant resident species detected during the 2004 breeding season were: mourning dove, Bullock's oriole, brown-headed cowbird, western kingbird, Abert's towhee, cliff swallow, ash-throated flycatcher, yellow warbler, lesser nighthawk and yellow-breasted chat (Figure 2). Species diversity, richness and evenness at the Pratt Restoration Site were 14.43, 32 and .7775 respectively (Table 3). Behavioral observations were recorded for 27 species (Table 4). The mean relative abundance of total individuals for all species and average species richness did not significantly differ between years. Red-winged blackbirds and mourning doves showed a significant difference of mean relative abundance between years ($p < .05$) (2002-2005). The mean relative abundance of red-winged blackbirds was significantly higher in year 2002 compared to 2003, 2004, and 2005. The mean relative abundance of mourning doves was significantly lower in year 2002 compared with 2004 and 2005.

Tape playback surveys for the southwestern willow flycatcher

Five migrant willow flycatchers were detected at the Pratt Restoration Site on May 17th, 2005 during southwestern willow flycatcher surveys. One migrant willow flycatcher was detected on June 8th, 2005 and one on June 14th 2005 during the area search surveys. For more extensive results of southwestern willow flycatcher surveys refer to "*tape playback surveys for the southwestern willow flycatcher 2005*" (USBR 2005).

Discussion

The Pratt Restoration Site is a monotypic cottonwood-willow habitat. The LCR MSCP calls for the creation of 5,940 acres of cottonwood-willow habitat as conservation measures for the following avian LCR MSCP covered species: southwestern willow flycatcher (*Empidonax trailii estimus*), western yellow-billed cuckoo (*Coccyzus americanus occidentalis*), elf owl (*Micrathene whitneyi*), gilded flicker (*Colaptes chrysoides*), gila woodpecker (*Melanerpes uropygialis*), vermilion flycatcher (*Pyrocephalus rubinus*), Sonoran yellow warbler (*Dendroica petechia sonorana*), Arizona bell's vireo (*Vireo bellii arizonae*) and summer tanager (*Piranga rubra*) (LCR MSCP HCP 2004). The Sonoran yellow warbler was the only LCR MSCP covered species present at the site during the breeding season; one 2nd year male summer tanager was detected on one survey.

The Pratt Restoration Site has not yet provided habitat for the majority of the LCR MSCP covered avian species, however; it has benefited other riparian associated species that breed along the LCR. Eight species listed in the LCR MSCP as sensitive non-covered riparian species were present at the site in moderate numbers: Abert's towhee, ash-throated flycatcher, blue grosbeak, Bullock's oriole, common yellowthroat, lesser nighthawk, Lucy's warbler, and yellow-breasted chat (LCR MSCP HCP 2004). The Abert's towhee, Lucy's warbler and willow flycatcher are listed as species of concern in the Partners in Flight North American Landbird Conservation Plan (Rich *et al.* 2004). This site has provided habitat for migrating willow flycatchers. There is no standard scale for species diversity, evenness or richness for the values at the Pratt Restoration Site to determine if our values would be considered low, medium or high. However; we can compare diversity, evenness and richness numbers to restored and non restored sites along the LCR. This comparison may be found in the report "*Avian post development monitoring of restoration sites along the Lower Colorado River, breeding season of 2005*"

The Pratt Restoration site was created to provide habitat specifically for the southwestern willow flycatcher (Raulston 2003). For a willow flycatcher to be considered a southwestern willow flycatcher, it must be present after June 21st (Sogge *et al.* 1997). This site has not yet fulfilled that objective. Possible reasons for the absence of southwestern willow flycatchers, as well as other LCR MSCP covered species, are the absence of constant water, lack of dense understory, lack of mature trees and small patch size of the habitat. The site is currently being managed to create more of an understory and subcanopy within the habitat which may provide more suitable habitat for the southwestern willow flycatcher and other LCR MSCP covered species (BLM 2004). Vegetation characteristics of the sites are monitored annually to observe how changes in habitat structure affect avian richness, diversity and abundance (USBR 2005).

Changes in species composition and abundance have been minimal as the Pratt Restoration Site matures. The only notable differences were mourning doves increased and red-winged blackbirds decreased as the site matured. The Pratt Restoration site is one of the first two restoration sites where avian use has been monitored. Avian species are good indicators of ecosystem health due to their sensitivity to environmental change regarding a variety of physical and biological factors (Greg Elliot *et al.* 2004).

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Table 1: Mean relative abundance of resident birds detected during area searches, per species at the Pratt Restoration Site, breeding season 2005

Common Name	Scientific Name	Mean relative Abundance	Standard Deviation	Standard Error
Gambel's quail	*Callipepela gambelii*	.40	.70	.22
killdeer	*Charadrius vociferous*	.20	.42	.13
white-winged dove	*Zenaida asiatica*	1.90	2.96	.94
mourning dove	*Zenaida macroura*	20.00	7.57	2.39
common ground-dove	*Columbina passerine*	.10	.32	.10
lesser nighthawk	*Chordeiles acutipennis*	2.80	6.35	2.01
black-chinned hummingbird	*Archilocus alexandri*	.20	.42	.13
Anna's hummingbird	*Calypte anna*	.80	2.53	.80
Gila woodpecker	*Melanerpes uropygialis*	.10	.32	.10
ladder-backed woodpecker	*Picoides scolaris*	.80	1.03	.33
black phoebe	*Sayornis nigricans*	.20	.63	.20
ash-throated flycatcher	*Myiarchus cinerascens*	3.10	4.82	1.52
western kingbird	*Tyrannus verticalis*	5.20	7.63	2.41
loggerhead shrike	*Lanius ludovicianus*	.50	.97	.31
northern rough-winged swallow	*Stelgidopteryx serripennis*	2.20	3.29	1.04
cliff swallow	*Petrochelidon pyrrhonota*	4.40	12.89	4.08
verdin	*Auriparus flaviceps*	.50	.97	.31
marsh wren	*Cistothorus palustris*	.10	.32	.10
black-tailed gnatcatcher	*Polioptila melanura*	.30	.95	.30
northern mockingbird	*Mimus polyglottos*	.10	.32	.10
Lucy's warbler	*Vermivora luciae*	.30	.68	.21
yellow warbler	*Dendroica petechia*	3.10	2.42	.77
common yellowthroat	*Geothypis trichas*	1.40	1.78	.56
yellow-breasted chat	*Icteria virens*	2.70	2.58	.82
summer tanager	*Piranga rubra*	.20	.63	.20
Abert's towhee	*Pipilo aberti*	4.90	3.51	1.11
blue grosbeak	*Guiraca caerulea*	.70	.68	.21
red-winged blackbird	*Agelaius phoeniceus*	1.90	3.48	1.10
great-tailed grackle	*Quiscalus mexicanus*	1.80	3.79	1.20
brown-headed cowbird	*Molothrus ater*	6.60	7.86	2.49
Bullock's oriole	*Icterus bullockii*	7.00	5.14	1.63
house finch	*Carpodacus mexicanus*	.60	1.08	.33

Table 2: Mean relative abundance of migrant birds detected during area searches, per species at the Pratt Restoration Site, breeding season 2005

Common Name	Scientific Name	Mean relative abundance	Standard Deviation	Standard Error
western wood-peewee	*Contopus sordidulus*	.10	.32	.10
willow flycatcher	*Empidonax trailii*	.30	.48	.15
dusky flycatcher	*Empidonax oberholseri*	.10	.32	.10
hermit thrush	*Catharus guttatus*	.10	.32	.10
western tanager	*Piranga ludoviciana*	.30	.95	.30
Lazuli bunting	*Passerina amoena*	.10	.32	.10

Table 3: Species richness, ecological species diversity and evenness at the Pratt Restoration Site for resident species, breeding season 2005

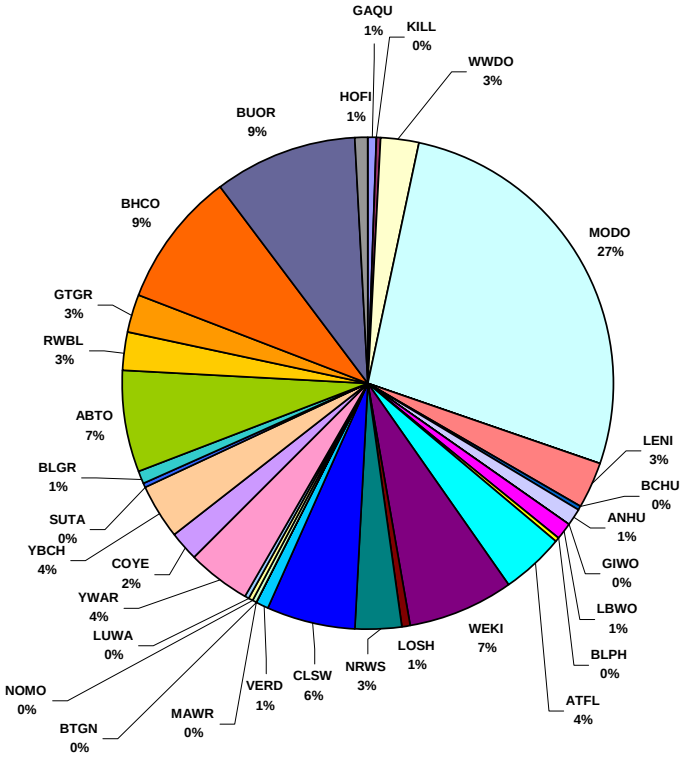
Area search section	species richness	ecological species diversity	evenness
1	21	12.42	.8280
2	20	9.58	.7432
3	24	13.43	.8174
4	20	10.70	.7911
5	18	10.77	.8222
Cumulative	31	14.43	.7775

Table 4: Behavioral observations at the Pratt Restoration Site, breeding season 2005.

Species	Forage	Nest	Carrying Food	Pair	Displaying	Fledge
killdeer	X					
white-winged dove	X	X		X		
mourning dove	X	X		X	X	X
lesser nighthawk	X					
black-chinned hummingbird	X					
Anna's hummingbird	X			X		
Gila woodpecker	X					
western wood-pewee	X					
dusky flycatcher	X					
black phoebe	X					
ash-throated flycatcher	X					
western kingbird	X			X		X
northern rough-winged swallow	X					
cliff swallow	X					
verdin	X					
Lucy's warbler	X					
yellow warbler						

common yellowthroat					X	
yellow-breasted chat		X				
western tanager	X					
Abert's towhee	X					
blue grosbeak	X	X				
red-winged blackbird	X			X		
great-tailed grackle	X			X		
brown-headed cowbird	X			X		
Bullock's oriole	X		X	X		
house finch						

Figure 1: Mean relative abundance of resident species at the Pratt Restoration Site, breeding season 2005



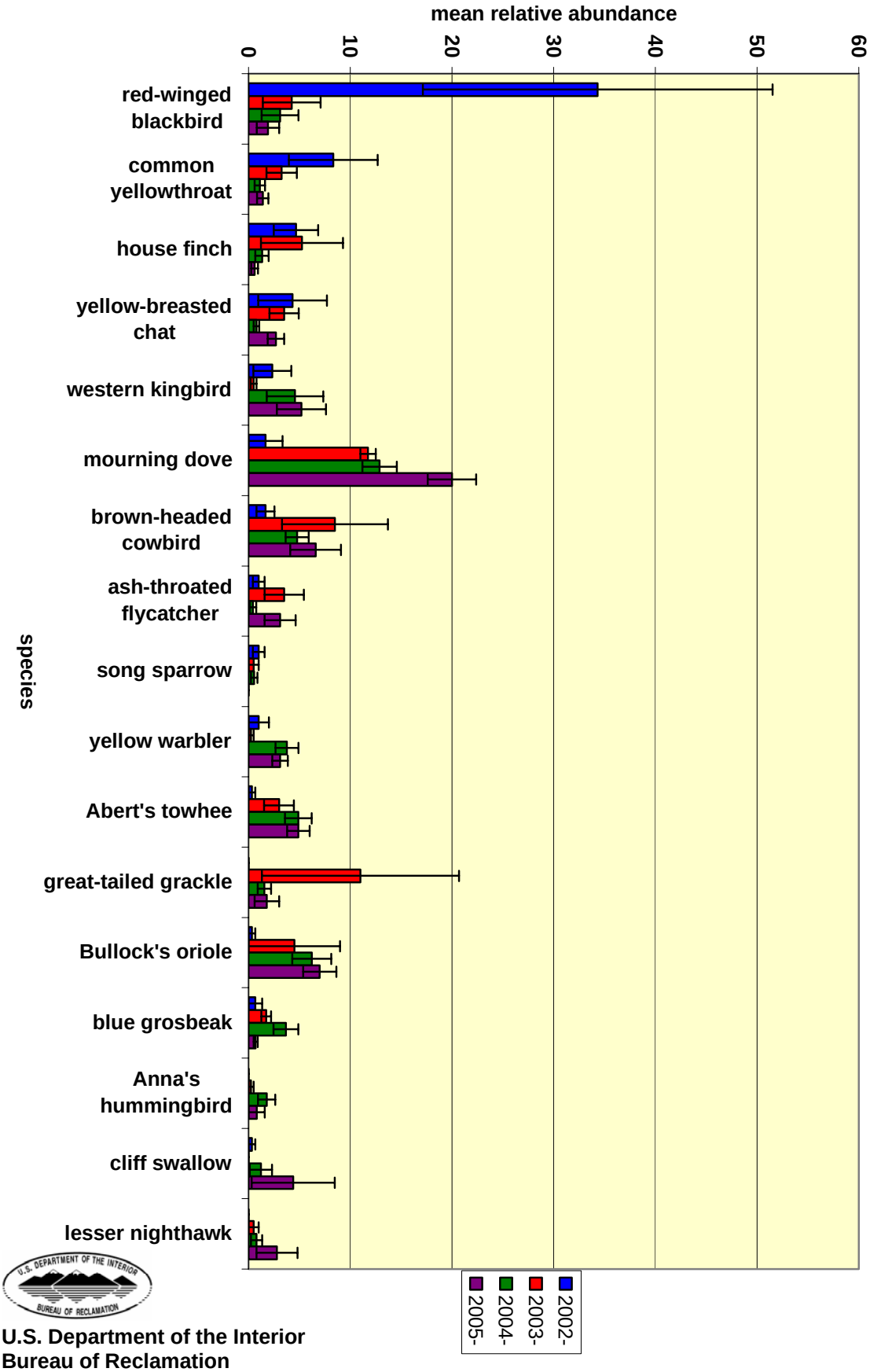


Figure 2: Comparison of mean relative abundance for the most abundant resident species and standard error bars at the Pratt Restoration Site, breeding season 2002-2005

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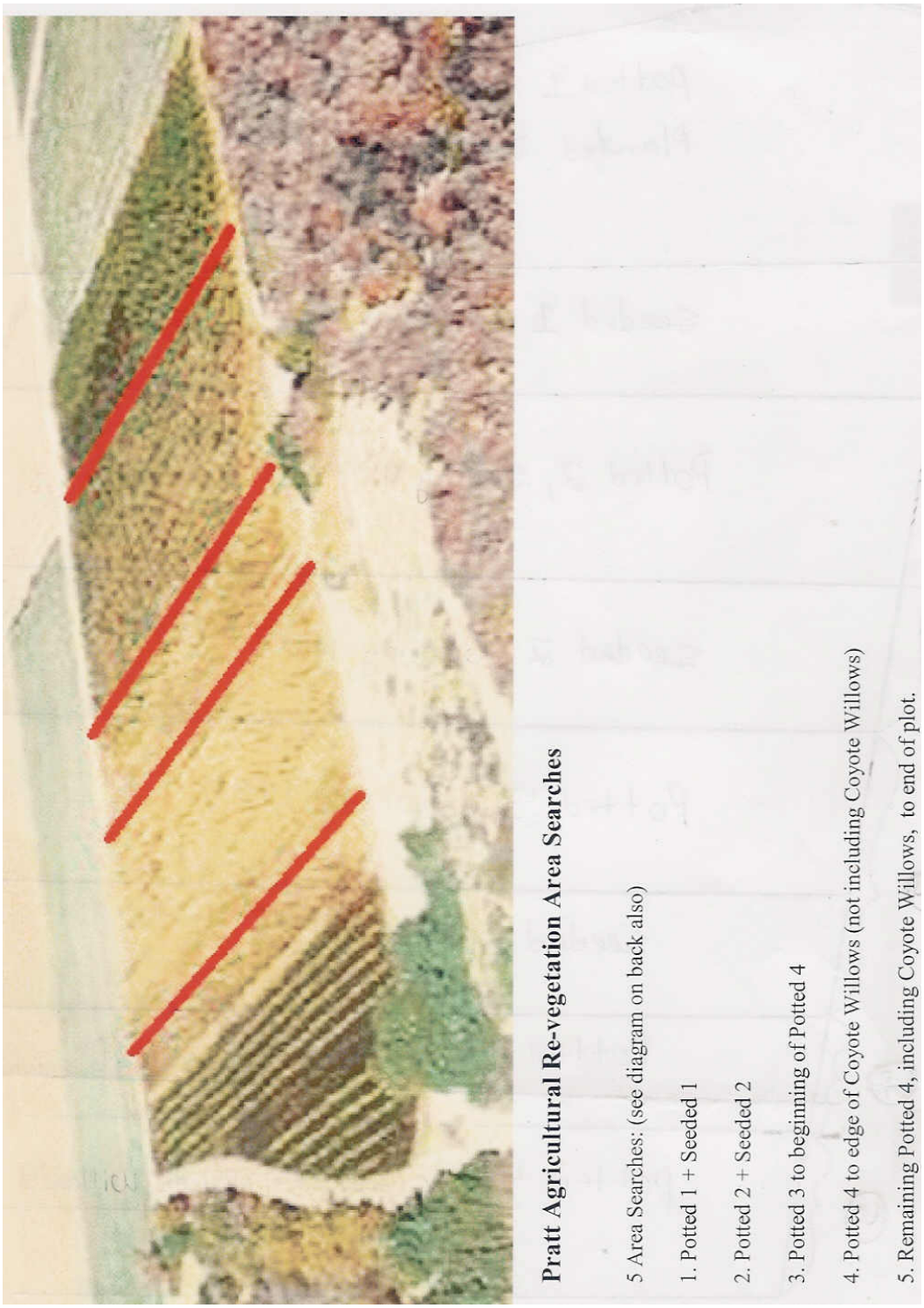
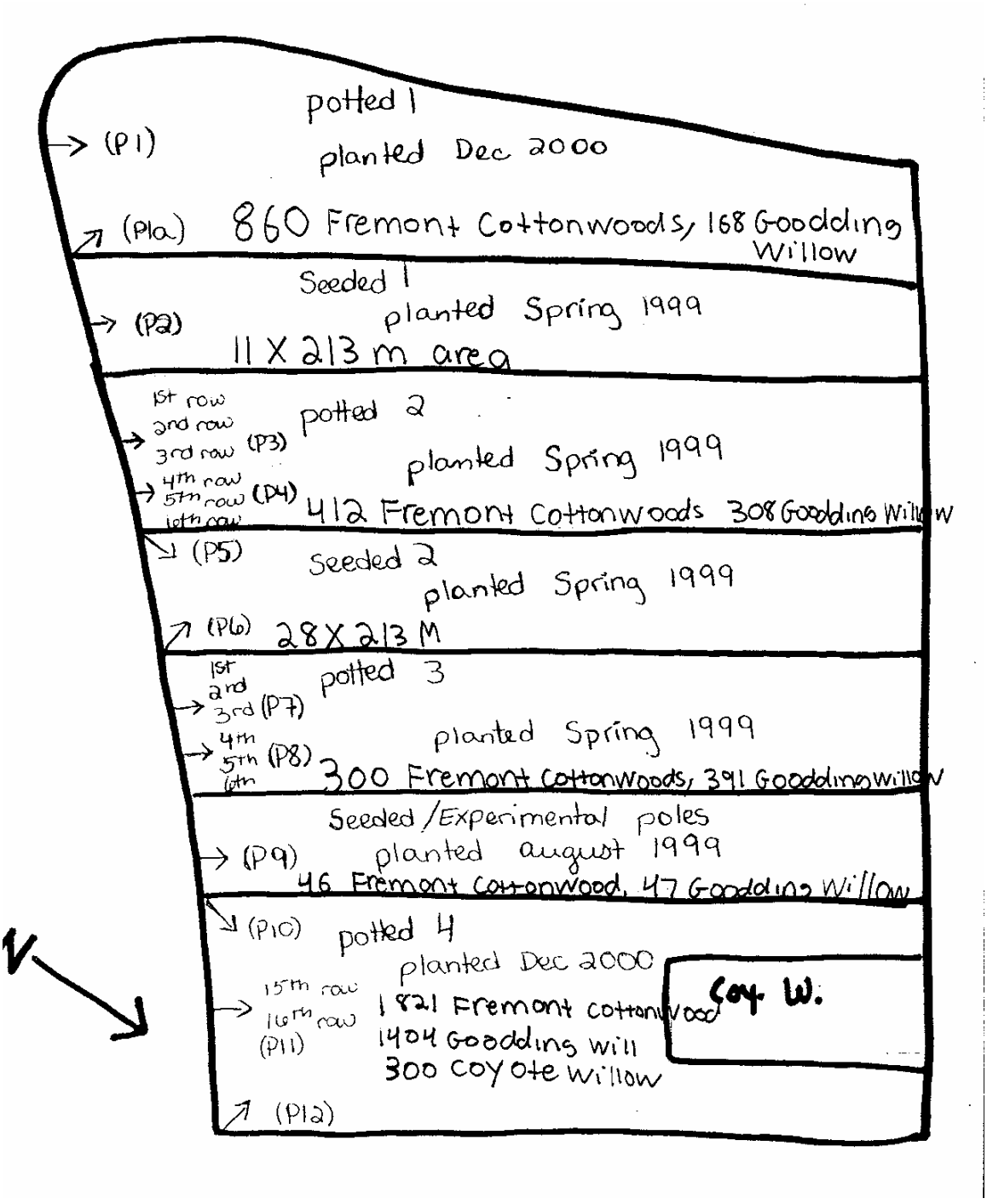
Appendix 1: Aerial view of the Pratt Restoration Site, number of trees planted in each area and area search sections.



Pratt Agricultural Re-vegetation Area Searches

5 Area Searches: (see diagram on back also)

1. Potted 1 + Seeded 1
2. Potted 2 + Seeded 2
3. Potted 3 to beginning of Potted 4
4. Potted 4 to edge of Coyote Willows (not including Coyote Willows)
5. Remaining Potted 4, including Coyote Willows, to end of plot.



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Appendix 2: Data form used for area searches

Pratt Agricultural Restoration Area Search Form

Date:_____ Section/Plot#:_____ Visit #_____
Observers:_____
Temp:_____ F or C Cloud Cover:_____ Wind:_____mph or kts
Start Time:_____ End Time: _____ Explain if not 20 minutes
Soil moisture conditions (note whether site is dry, moist, flooded, appeared to have been recently irrigated, adjacent irrigation in farm fields)_____

Species	Tally of Individuals (Song, Visual, Call, one letter per individual)	TOTAL	Behavior (check if applicable)*								
			forag.	flock	copul.	displ.	pair	carry mater.	food	nest	fledg.

*Forag. = foraging, Copl. = copulation, Displ. = courtship or territorial display, Food carry includes fecal sack, Fledg. = fledgling.

Notes and flyovers:_____

_____

_____

Other Observers:_____

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April 2006

Appendix 3: Standard AOU (American Ornithological Union) Codes used for North American Bird Species.

Code	Common Name	Scientific Name
GAQU	Gambel's quail	Callipepela gambelii
KILL	Killdeer	Charadrius vociferus
WWDO	white-winged dove	Zenaida asiatica
MODO	mourning dove	Zenaida macroura
COGD	common ground-dove	Columbina passerine
LENI	lesser nighthawk	Chordeiles acutipennis
BCHU	black-chinned hummingbird	Archilocus alexandri
ANHU	Anna's hummingbird	Calypte anna
GIWA	gila woodpecker	Melanerpes uropygialis
LBBO	ladder-backed woodpecker	Picoides scolaris
GIWO	gila woodpecker	Melanerpes uropygialis
BLPH	black phoebe	Sayornis nigricans
ATFL	ash-throated flycatcher	Myiarchus cinerascens
WEKI	western kingbird	Tyrannus verticalis
LOSH	loggerhead shrike	Lanius ludovicianus
NRWS	northern rough-winged swallow	Stelgidopteryx serripennis
CLSW	cliff swallow	Petrochelidon pyrrhonota
MAWR	marsh wren	Cistothorus palustris
BTGN	black-tailed gnatcatcher	Polioptila melanura
NOMO	northern mockingbird	Mimus polyglottos
LUWA	Lucy's warbler	Vermivora luciae
YWAR	yellow warbler	Dendroica petechia
COYE	common yellowthroat	Geothypis trichas
YBCH	yellow-breasted chat	Icteria virens
SUTA	summer tanager	Piranga rubra
ABTO	Abert's towhee	Pipilo aberti
BLGR	blue grosbeak	Guiraca caerulea
RWBL	red-winged blackbird	Agelaius phoeniceus
GTGR	great-tailed grackle	Quiscalus mexicanus
BHCO	brown-headed cowbird	Molothrus ater
BUOR	Bullock's oriole	Icterus bullockii
HOFI	house finch	Carpodacus mexicanus